NATURAL RESOURCES MANAGEMENT: ISSUES AND LESSONS FROM RWANDA

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by

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SUMMARY

This paper describes how the U.S. Agency for International Development (USAID)/Rwanda is working with the Government of Rwanda and other donors to identify and resolve key issues related to the management of the country's renewable natural resources--its forests, soils, and water. The purpose of the study is to illustrate how small countries and Agency for International Development (A.I.D.) Missions with limited resources can incorporate natural resources management into development activities in general and in Sub-Saharan Africa in particular. More specifically, USAID/Rwanda's experience provides insights into the requirements of integrating natural resource management objectives into A.I.D.'s agricultural and rural development programs.

Major findings of the study include the following:

Importance of Government Support

Government support is a prerequisite to developing the necessary long-term strategies to address specific natural resource management issues. The Rwandan Government's interest in addressing these issues has been instrumental in creating a supportive policy and institutional environment and in generating donor support that progressed quickly from tree-planting campaigns to more long-term strategies to deal with specific natural resource management issues.

Development of Natural Resource Management Technologies

Technology development for improving natural resources management is no less complex than that associated with conventional agriculture. For example, technologies for dealing with problems such as deforestation, soil erosion, and decline in soil productivity will have to take into consideration local agroecological conditions. Thus, natural resource management projects with technology development components should provide adequate support for site-specific applied research.

Complexity of Natural Resource Management Issues

Donors should appreciate the difficulty host countries face in addressing natural resource management issues while also trying to balance development, conservation, and equity objectives.

Rwanda's situation poses a dilemma common in many countries. On the one hand, practical and effective solutions are urgently needed to control population growth, increase agricultural production without further detriment to the land base, and manage the remaining natural forests and other wildlands for sustainable production and conservation purposes. On the other hand, social, political, and institutional constraints have to be considered as well, and issues related to these are often more difficult to resolve.

Donor Coordination

USAID/Rwanda's assistance to the Government of Rwanda focuses on a wide range of activities, including management of natural forests, wildlife habitats, and marshlands; conservation and replenishment of soils using agroforestry and other simple techniques to establish a protective tree cover on hill slopes and on farms; and dissemination of tree species and other perennials that can yield useful products for local communities. Because other donors are also sponsoring such activities, USAID/Rwanda's natural resource management projects include approaches that complement those of other donors. In support of a multi-donor effort to help the Rwandan Government develop a management strategy for protecting a large natural forest, USAID/Rwanda is sponsoring staff training programs and construction of a center to educate the public about wildlife conservation. In conjunction with an effort led by the World Bank, the Mission is also providing technical assistance to strengthen the ability of the Government's Ministry of Planning to undertake environmental planning and management.

Innovative Approaches

Apart from support for standard reforestation projects, USAID/Rwanda's contribution to the Government's natural resource management program highlights several innovative environmental conservation approaches that could be incorporated into an A.I.D. agricultural and rural development program. They include (1) promoting tourism and other nondestructive uses of natural forests in conjunction with wildlife conservation and park management and (2) promoting agroforestry and fish-farming to conserve soil and water resources while increasing farm productivity. In short, these activities have both ecological and economic benefits.

However, there are drawbacks to promoting such activities in the context of A.I.D. Mission's agricultural and rural develop-

ment projects. Natural resource management projects can be difficult to appraise in purely economic terms for project funding purposes. They often require costly investments, the major ecological and economic benefits of which may not be apparent for many years or cannot be easily estimated during project planning. Consequently, project designers may find it inappropriate to use standard cost-benefit analysis as a criterion for determining the returns on investments in such activities because it would not take into account the long-term or nonquantifiable benefits. Without a strong economic justification for such investments, a Mission with a limited development budget might find it difficult to justify placing a higher priority on supporting natural resource management investments over other types of development activities that can yield more immediate and tangible benefits.

This does not mean that economic criteria should not be used to appraise natural resource management approaches that require long-term investments or are research-oriented and experimental. Rather, it underscores the need for project designers to (1) take into account the ecological as well as the economic contribution of a natural resource management activity, (2) consider investments from a long-term as well as a short-term perspective, and (3) include qualitative as well as quantitative benefits in assessing the potential returns on investments. In other words, a broader framework than a simple cost-benefit analysis of a proposed activity might be required.

Rwanda's experience suggests several measures that can be incorporated into A.I.D.'s development programs in other developing countries:

-- Encourage support from the host country government by funding studies of existing or emerging natural resources management issues to heighten awareness and to identify how these measures could be included in development programs.

-- In dealing with complex natural resources issues, collaboration with other donors in funding studies and activities might be necessary, and these could be undertaken with support from A.I.D. centrally funded projects.

-- A.I.D. could develop natural resource management programs covering a range of interventions from, for example, small-scale, on-farm agroforestry, soil conservation, and water management activities to projects covering large areas that combine resources conservation with development activities.

GLOSSARY

AFRENA	-	Agroforestry Research Network for Africa
A.I.D.	-	U.S. Agency for International Development
EEC	-	European Economic Community
marais	-	marsh, wetlands
NRMP	-	Natural Resources Management project
PVO	-	private voluntary organization
RRAM	-	Ruhengeri Resource Analysis and Management project
Tilapia nilotica	-	fish originally found in the Nile
umuganda	-	group organized to provide free communal labor to commune
USAID	-	A.I.D. field Mission

1. INTRODUCTION

This paper describes how the U.S. Agency for International Development (USAID)/Rwanda--a small Mission with a direct-hire professional staff of only seven people--is working with other donors and the Government of Rwanda to identify and resolve key issues related to the management of the country's natural resources. As a small donor, USAID/Rwanda's assistance focuses on (1) small-scale projects that deal with resource management issues pertaining to smallholder agricultural development and (2) protection of remaining forests. The two areas are central to the Agency for International Development's (A.I.D.) strategy to incorporate natural resources management in its development activities in general and in Sub-Sahara Africa in particular. USAID/ Rwanda's experience, therefore, provides insights into the requirements of integrating natural resource management objectives into A.I.D.'s agricultural and rural development programs. More generally, Rwanda's experience offers examples of approaches USAID Missions could use in conjunction with other donors in resolving problems or implementing projects that a single donor or the host country cannot adequately manage alone.

2. RATIONALE FOR SELECTING RWANDA AS A CASE STUDY

Improving management of the natural resources in Rwanda illustrates three basic problems commonly confronted by many underdeveloped countries. Rwanda's efforts to resolve them offer an example of key issues that are likely to confront designers of natural resource management projects elsewhere.

First, many low-income developing countries do not give high priority to environmental and natural resource management issues. The Government of Rwanda is an exception. It has already taken important steps toward introducing policies and sponsoring projects to promote reforestation and soil conservation. Since l980, annual public campaigns have encouraged community-level activities in support of these conservation themes. For example, l980 was the Year of Soil Conservation; l982, the Year of the Fight Against Erosion; l983, the Year of the Tree; and l985, the Year of Composting (Millington l987). In response to these campaigns, villagers in many communes planted trees along roadsides and in communal woodlots, compost pits were dug by each household, antierosion structures were constructed on farms, and communal tree nurseries were established. Umuganda work groups supplied the labor for community-level tree-planting, but the Government sought donor assistance to establish tree plantations to meet the urban market demand for fuelwood and other wood products.

Observers have noted that the results of the campaigns have been impressive (Millington l987). On National Tree-Planting Day, Rwandans plant as many as 30,000 trees. It is estimated that Rwanda currently has more land planted with trees than at the time

of independence 27 years ago. Between l982 and l985, the net annual increase (i.e., after subtracting the land area lost to deforestation) in reforested land was l8,000 hectares (ha). By 1987, the rate of tree-planting was 22,500 ha per year. The impact of the soil conservation campaign has been equally impressive: the area covered by various soil conservation structures increased from 15 percent to 63 percent. Rwandan officials are currently focusing on resolving implementation problems related to these initial efforts and on implementing long-term plans to protect the country's remaining natural forests and wildlife habitats (see Section 3). In short, Rwanda exemplifies how a government's support for natural resource management can produce impressive results. Once progress is made on immediate problems, government efforts can shift to developing long-term strategies to address specific natural resource management issues.

Second, Rwanda's location in the East African highlands illustrates the type of agroecological factors that should be considered in formulating national strategies to manage natural resources. In Rwanda's case, the strategy must take into account the significant variation among Rwanda's 12 agroecological zones with respect to topographic features, climatic characteristics, farming practices, and potential for future economic development. Furthermore, significant microecological variation occurs within these zones. Under these conditions, the approach to developing technical solutions for such problems as deforestation, soil erosion on cultivated hill slopes, and decline in soil productivity will have to be site-specific. For example, an A.I.D.supported study found that a regional rather than a national strategy is more appropriate for developing programs to curb soil erosion and depletion, given the variation in soil type, slope gradient, cultivation practices, vegetation cover, and the quantity and intensity of rainfall in each of the agroecological zones (Lewis et al. 1987). Rwanda's situation underscores the need for flexibility in developing technologies to ensure their suitability for local agroecological conditions.

Rwanda illustrates a third, and most challenging, scenario. As in many developing countries, Rwanda's problems of resource degradation are closely tied to pressure exerted on a limited land base by a large and rapidly growing population, 90 percent of whom are engaged in agriculture. The average population density on arable land is 390 persons per square kilometer, increasing to 472 per square kilometer in the volcanic highlands in the western region of the country. The population is growing at a rate of 3.7 percent per year, resulting in relentless pressure on lands for farming, raising livestock, and other agricultural production. In many areas of the country, intensive crop cultivation is being practiced on land that cannot sustain such practices or land that should be set aside for environmental conservation. This

trend is most evident in hilly areas, where every slope is intensively cultivated, even very steep slopes (greater than 50-degree gradient). Elsewhere, intensive farming occurs within, or is juxtaposed to, important forest reserves and watersheds.

The pressure for agricultural land is coming from the wealthy, as well as the poor. In fact, the wealthy are better able to respond to opportunities to use land for commercial agriculture, especially livestock production (an activity that has high social status). This is well demonstrated by the eagerness with which wealthy individuals are setting up cattle ranches to take advantage of new pastures and milk-processing facilities established under a World Bank project in the Gishwati Forest.

Farming is more intensive in areas where idle land for agricultural production is no longer available. Intensive culture is especially prevalent where farms have been subdivided several times as they pass from one generation to the next. In many cases, the inherited farm lots are often too small (averaging 1.2 ha) to support a family. The farmers attempt to compensate by growing more than one crop (often the wrong crop) on the same land in very short cycles, but often without adding fertilizer (organic or inorganic) to nourish the soils. The long-term result is a steady decline in agricultural productivity as soils are depleted of nutrients.

Under the circumstances described above, it is extremely difficult for the Government of Rwanda to strike a balance between development, conservation, and equity objectives, especially with regard to the management of public land resources. Thus, Rwanda's situation poses a dilemma common to many countries. On the one hand, practical and effective solutions are urgently needed to control population growth, increase agricultural production without further detriment to the land base, and manage the remaining natural forests and other wildlands for sustainable production and conservation purposes. On the other hand, social, political, and institutional constraints have to be considered as well, and such issues are often more difficult to resolve.

3. NATURAL RESOURCE MANAGEMENT ISSUES IN RWANDA

3.1 Geographic Setting

Much of Rwanda is hilly terrain, with an altitude of at least 1,000 meters above sea level and increasing generally from east to west to more than 4,000 meters. Except for wetland areas in the floodplains, a few national parks, and forest reserves, the rest of the country is under intensive agriculture.

The western border of the country comprises the Zaire-Nile Divide, a series of mountains that is the watershed for major agricultural regions of Rwanda and the neighboring countries Burundi and Zaire. The Zaire-Nile Divide also contains remnants of the Afromontane forests. As such, it serves another equally important function--providing forests that have a high degree of biological diversity and rare animal species (e.g., the mountain gorilla, golden chimpanzee, lhoest's monkey, ruwenzori colobus monkey, and black-fronted duiker). A large proportion of the bird species and flora found in these forests is also unique. Another wildlife sanctuary--the Akagera National Park--is located in the eastern savannah region of the country. But population pressures have drastically reduced the land area under these natural forests from approximately 30 percent at the turn of the century to 7 percent of the total land area of Rwanda.

Issues concerning how to manage Rwanda's natural resources revolve around improving the management of forest, soil, and water resources to sustain its agricultural economy and to prevent loss or further degradation of the remaining natural ecosystems. Four topics are central to the Government's development program:

-- Protection and management of natural forests

-- The control of soil erosion and the restoration of soil fertility in cultivated areas, particularly on hill slopes

-- Development and management of riverine systems and wetlands

-- Environmental management

These issues and their implications for development activities are discussed in this section.

3.2 Wildlife Conservation and Sustainable Management of Natural Forests

The central issue concerning the management of Rwanda's natural forests is how to strike a balance between conserving them as intact biological ecosystems and using portions for sustainable economic activities. Such activities include production of fuelwood and forestry products, wildlife tourism, mining, quarrying, and farming that would not incur permanent damage to the forest ecosystem. Heavily populated and cultivated areas adjacent to the forest reserves complicate the situation. Despite legal prohibitions, the local population has historically

used the forests for hunting and collecting wood and other forest products to supplement their livelihood. Moreover, the international market demand for rare wildlife species makes it virtually impossible to eradicate poaching. Therefore, a key factor in the equation is how to accommodate different groups with conflicting interests in the forests. The high cost of keeping a close surveillance on the forests makes it impractical to rely solely on the Government and legal measures to protect them.

Several donor-sponsored projects are being implemented to address this issue. The approaches used in these projects are described below.

3.2.1 Use of Forests for Recreational and Research Purposes

The conventional approach of developing forest reserves for tourism and research has been successful in Rwanda. Rwanda's tourism program is based on the wildlife reserves in the Volcanoes National Park, located in the northwest region of the country, and in the Akagera National Park and Game Reserve in the northeast. Tourism is currently the fourth major source of foreign exchange for the Government. Its role in generating foreign exchange is crucial, in view of declining earnings from tea and coffee exports in recent years.

The principal attraction of the Volcanoes National Park is a highly successful sight-seeing program to view mountain gorillas in their natural habitat. The tourist program began in l979 with technical assistance from the Mountain Gorilla project, funded by the African Wildlife Foundation and Belgian aid. The project's principal objective is to protect the mountain gorillas that live in the park's forest and to conduct research on the viability of the species, including habituating a portion of the population for tourist viewing. The tourist program has been an economic success, generating $400,000 in park receipts and an estimated $2.3 million per year in indirect earnings from hotel accommodations, restaurants, vehicle rentals, and the like.

However, the success of the tourism component of the Mountain Gorilla project is a mixed blessing. On the one hand, the revenue generated by the park and the publicity associated with the mountain gorillas guaranteed Government commitment to proper management of the facility. On the other hand, its very success has resulted in increased pressure to accommodate more tourists than should be allowed. The park management is concerned that too many tourists per group will lower the quality of the visitors' experience and at the same time place unacceptable stress on the mountain gorillas. Park managers fear that the publicity

from the recent movie Gorillas in the Mist will create even more demand.

The USAID/Kigali Natural Resources Management project (NRMP) will fund an applied research program to sponsor studies to improve park management and scientific understanding of the biological ecosystems of the forest reserves in the two parks. The NRMP will also support a Conservation Education Program to increase the awareness of the local population about the value of conservation. Belgian aid is also sponsoring park management training and promotion of conservation in the Akagera National Park.

3.2.2 Multiple-Use Management of Natural Forests

Managing the remaining natural forests in Rwanda--the Nyungwe Forest, the Gishwati Forest, and the Mukara Forest--is not as straightforward as park management. Tourism is one possible approach but is unlikely to generate the financial resources required to maintain the forests as parks solely for recreation. Moreover, the potential for developing tourism is less for the forests than for the Volcanoes Park because the forests do not house big "drawing cards" such as the mountain gorillas.

Management is further complicated because the remaining forests are not uniformly "natural." Large portions of the Gishwati and Mukara forests and the edges of the Nyungwe Forest are already so degraded that rehabilitation to regain their natural state (e.g., enrichment planting to regenerate the natural flora) would be too costly. In addition, the commercial value of timber from the natural stands in the forests is low, so that largescale exploitation (even on a sustainable yield basis) is not economic. Finally, experience indicates that other measures besides legal protection are necessary to address the existing threat to the forests. The degradation of the forests results from demand for their products--fuelwood, building poles, cassiterite, gold, browse for livestock, wildlife, and other products valued by the local population and international market. This will not be stopped by legislation. Given the size of the areas concerned (more than l20,000 ha), the financial resources and personnel required to keep the remaining forests under surveillance for conservation purposes alone would be prohibitive. In short, by necessity, the remaining forests in Rwanda have to be managed for multiple purposes.

The Government of Rwanda's Action Plan for the Nyungwe Forest (which covers 97,000 ha) follows a multiple-use strategy. The forest will be used for three purposes. Approximately 40 percent will be set aside and fully protected as a forest reserve. The remainder will be managed for controlled use on a

sustainable basis. For example, traditional uses--cutting wood, grazing of livestock, collecting honey, and hunting--will be permitted but regulated. Along the periphery of the reserve, trees will be planted to form a "buffer zone" between the local population and the forest. For funding purposes, the forest has been divided into four blocks. The World Bank, the French, the Swiss, and the European Economic Community (EEC) have each agreed to fund the management of a block.

At present, the management activities in each block focus on (1) collecting information for a forest inventory to be used for future forest management and scientific purposes; (2) constructing access roads to the scientific research center in the forest reserve; (3) training programs; and (4) implementing plans for the buffer zone. The buffer zone will comprise a strip of tree plantations to demarcate the forest border and to serve as a barrier against unauthorized access. Guards will be employed to patrol the buffer plantations and the natural forest. Extension workers will provide advice and conservation education to the local population to sensitize them on the use and ecological value of the forest.

3.2.3 Reforestation

Reforestation projects are designed to relieve pressure on natural forests for wood and other economically valuable products by establishing plantations composed of desired tree species. Plantation forests can be harvested on a sustainable basis, and the permanent tree cover provides ecological benefits such as watershed protection, control of soil erosion, and moderation of local climate. As discussed earlier, the Government of Rwanda actively promotes reforestation. Thirteen donor projects are implementing reforestation on approximately 37,000 ha. Of these projects, 12 were begun in the l980s, including the World Bank’s two-phase Integrated Forestry project that will eventually establish 4,000 ha of tree plantations in the Gishwati Forest to produce wood for the urban market.

The Government of Rwanda is encouraging local communes to develop plans to plant trees in small woodlots for wood and other uses such as fodder and green mulch. Many communes have established woodlots with assistance from donors and private voluntary organizations (PVOs). USAID/Kigali has supported two such commune-level reforestation projects. One of them is the CARE Gituza Forestry Project. The success of the silvicultural experiments and extension programs developed under the Gituza project has drawn additional support from the Netherlands and other donors and encouraged USAID/Kigali to continue sponsoring commune-level reforestation. USAID/Kigali’s Natural Resource Management project will set aside funds for cooperative agreements with PVOs--CARE as well as other interested parties--to implement

similar commune-level reforestation activities elsewhere in the country.

3.3 Soil Conservation and Agroforestry in Cultivated Areas

Soil erosion and depletion leading to a decline in agricultural productivity is a major problem in smallholder agriculture. As new lands for agricultural expansion are becoming increasingly scarce, the Government's search for new ways to increase smallholder agricultural production has focused on more intensive and improved management of cultivated areas. One strategy has been to introduce legislation requiring farmers to adopt simple techniques to reduce soil loss and to replace soil nutrients. However, the variability in Rwanda's agronomic conditions and topographic features precludes adoption of a single, "government approved" technique for curbing soil loss.

Moreover, socioeconomic constraints discourage farmers from adopting recommended technologies. Observers point out that the laws requiring farmers to adopt two practices--infiltration ditches and compost pits--have had mixed results. Infiltration ditches are intended to reduce runoff and soil loss on hill slopes, but they are not always appropriate or needed. For example, on very steep slopes (e.g., where the gradient exceeds 25 percent), infiltration ditches can accelerate land slippage, and on hills with gradients of less than 5 percent, they are simply unnecessary. As for compost pits, critics have noted that most farm families have constructed them, but more from fear of fines than from their desire to use compost to fertilize their crops. Others have cited the investment costs, time, and labor associated with the production of animal or green manure as reasons for the lack of farmer interest in using organic materials to enrich the soil (Millington l987). In short, the experience so far cautions against haste and the assumption that a universal application exists to reduce soil erosion and restore soil fertility throughout Rwanda.

Experience of a few pilot projects indicate that the situation is far from hopeless. Agroforestry technologies (e.g., planting leguminous tree species on contour lines and terraces) to reduce erosion and to produce fodder and organic fertilizer are generally accepted as the answer for Rwandan farming systems. One well-known example is the agropastoral project in Nyabisindu, funded by the Federal Republic of Germany. Agroforestry techniques were introduced gradually through incremental modifications to the traditional crop-and-livestock farming system. Key elements to changing farming practices under the project include focusing on small farming systems, working closely with local government and nongovernment extension services, and designing

effective extension programs. The project demonstrated to farmers that they could improve their maize production fourfold after a first season of adopting the green manure fertilization techniques. Livestock production also increased when farmers followed recommended husbandry practices.

At least seven other donor projects employ soil conservation, livestock husbandry, and agroforestry technologies. USAID/Kigali's Ruhengeri Resource Analysis and Management (RRAM) and Farming Systems Research projects and CARE's Gituza Forestry project have made some progress in addressing research and extension questions. The RRAM project set up test plots in Ruhengeri prefecture to collect data on soil erosion and the effects of different antierosion treatments on various slope gradients. The findings will provide both information to guide the development of an appropriate extension program and a methodology to collect the same information elsewhere in the country. The Farming Systems Research project is conducting adaptive alley--cropping trials with different agroforestry tree species and under different cropping associations and management practices. The experiments have shown that by incorporating the production and use of green manure in existing farming practices, crop yields can be increased significantly. The USAID/Kigali NRMP will sponsor agroforestry research in Rwanda under the centrally funded Agroforestry Research Network for Africa (AFRENA) project. The NRMP will also fund commune-level efforts to develop extension programs that promote on-farm use of soil conservation and agroforestry techniques. The World Bank's Second Integrated Forestry project has a similar component to encourage farmers to produce fuelwood and fodder by practicing agroforestry along with livestock production and farming. The EEC's project in the Nyungwe Forest is similarly promoting agroforestry in conjunction with its efforts to create a buffer zone in the forest.

Notwithstanding the progress made by the USAID/Kigali project and other donor projects in addressing technical issues, it is too early to predict their long-term potential impact. This will clearly depend on how well the technologies developed by the project will be transferred to, and received by, farming communities. However, the success of the West German project in Nyabisindu provides three lessons worth noting. First, to be effective, extension messages should be consistent with existing farming systems. Second, required changes in farming practices should be introduced on an incremental basis. Third, besides reducing soil erosion or improving soil productivity, the techniques should generate tangible economic benefits for farmers. However, the Nyabisindu project evolved over 20 years, thus raising the question of whether quicker, lower cost methods to introduce agroforestry can be developed.

3.4 Development and Management of Riverine Systems: Large Versus Small Marais

The demand to convert more land to agriculture has also led to efforts to reclaim marshes--marais--for farming and other development purposes. A series of wetland areas, the marais are the natural floodplains for the rivers and lakes of the country. A few large-scale marais development projects have installed irrigation and drainage facilities to regulate water flow and to allow cultivation of crops such as rice, sugar, and vegetables on the reclaimed land. These projects require costly investments and are, therefore, mainly Government- and donor-funded. Because little is known of the hydrology and ecology of the marais, large-scale reclamation portends significant environmental risks. In the past, a few donor-funded projects with faulty engineering designs caused serious hydrological and ecological damage to the marais they attempted to drain (Millington l987).

Efforts by individual farmers and cooperatives have concentrated on the small marais. They invest in modest and low-cost infrastructure, such as elevated beds to grow an additional crop, ponds to raise fish for the market, and canals to rechannel water for irrigation and household use. Other activities include mining sand, gravel, and clay to make bricks, tiles, pots, and cement; harvesting peat and papyrus for fuel; and during the dry season, allowing livestock to graze in the open areas (Millington l987).

In support of the Government of Rwanda's National Fish Culture Program, USAID/Kigali's Integrated Fish Culture project encouraged farmers to construct ponds in the small marais to raise fish for the market. The project not only succeeded in reintroducing Tilapia nilotica, a fish originally found in the Nile, but also demonstrated the profitability of commercial fish culture to farmers. Average annual income generated by each pond is estimated at $3,100. Moreover, farmers learned to integrate fish culture with their livestock and crop cultivation practices, so that overall productivity and efficiency were increased in a self-sustaining system through recycling of organic materials produced on the farm. The project was able to cover 45 percent of its operating costs from sale of fingerlings and other products. USAID/Kigali's NRMP will provide additional funding to expand the project.

An A.I.D.-supported study concluded that the small-scale efforts mentioned above are economically profitable and environmentally sound (Sikkens and Steenhuis l988). Although the study pointed out the potential for increasing the economic productivity of the small marais, it also noted the need to carefully consider and resolve the institutional, socioeconomic, and ecologi-

cal constraints. For example, the study identified land tenure insecurity as a major disincentive for marais users to invest in more efficient technologies. Under Rwandan law, all marais belong to the Government. Individuals can rent this land from their local commune authorities, but their claim to any investments they may have made on the land is not ensured. Tenants can be evicted or their property destroyed without any compensation. While this legal restriction was originally designed to prevent misuse of the marais, it has inadvertently discouraged tenants from taking care of the property or making long-term investments. Yet, proper management of the marais will, in most cases, require such commitment from users as well as extensive research and mitigating measures to minimize environmental damage associated with their development. This ecological concern is especially warranted given the interrelated functions of both the large and small marais in Rwanda's drainage system. USAID/Kigali's NRMP will sponsor additional studies focused on a small marais (approximately 50 ha). The studies will examine the issues related to small marais development identified in the 1988 Sikkens and Steenhuis study funded by A.I.D. The findings will provide practical guidance on improving the management of the small marais.

3.5 Plans for Environmental Management

Natural resource management experts agree that it is important to adopt an intersectoral perspective in planning, formulating policy, and monitoring natural resource development. This perspective is necessary to identify off-site as well as on-site environmental consequences and related benefits and costs of actions taken or not taken. Conventional project economic analyses tend to omit off-site environmental impacts, variously termed "externalities," or "secondary" and "indirect" effects. Consequently, project designers and policymakers frequently underestimate or fail to consider significant environmental impacts (both positive and negative) associated with development activities. Negative effects on sites downstream from a project area, such as loss of wildlife habitats, flooding, and sedimentation, and public health risks are often not identified at all in the course of designing development programs.

The Rwandan Government is aware of the need to analyze environmental issues related to its development programs and to address these issues from an intersectoral perspective. As a first step, it has recently established in the Ministry of Planning an office for environmental affairs that will be responsible for planning national environmental policy and coordinating such activities of all Government ministries. As in many developing countries, however, the information required to conduct inter-

sectoral analyses is either not available or too expensive to obtain. The technical expertise necessary to conduct such analyses may not be available locally. Furthermore, government agencies responsible for planning development projects lack financial and staff resources to undertake environmental planning, especially those that require highly trained technical personnel.

The World Bank and A.I.D./Washington are leading a multi-donor effort to address these constraints by formulating an "Environmental Action Plan" for Rwanda. USAID/Kigali's NRMP will appoint an adviser to provide technical assistance to the Ministry of Planning for 2 years. In conjunction with funding from the World Bank, the project will sponsor studies on environmental issues and provide funds for logistical support and office equipment. The studies will deal with four topics: (1) ecological implications of demographic pressure on regional growth; (2) deterioration of natural habitats as a result of development; (3) deterioration in socioeconomic conditions caused by scarcity of arable land, unemployment, and crowded living conditions; and (4) interrelationships among the natural environment, urban development, industrialization, and human health.

The findings from the studies will provide guidelines and a framework "for the rational inclusion of the 'environmental component' into sectoral policies" (World Bank l988, 1). Analyses will focus on recommending approaches that the Government of Rwanda can follow to ensure coordination of environmental conservation activities across the ministerial, prefectural, and communal levels of government. Preliminary analyses are under way. At the completion of the studies, donors and the Rwandan ministries will meet to discuss findings and measures to be taken in formulating a national strategy for environmental management.

4. CONTINUING PROBLEMS

The Government of Rwanda's policies and support for donor-sponsored projects clearly demonstrate a commitment to improve the management of the country's natural resources. Since implementation of the policies and projects has only started recently, it is too early to assess their impact, except in the narrow sense of project-level accomplishments. Nevertheless, as noted below, two problems are likely to affect the implementation and impact of the Government's resource management program.

4.1 Investment Costs and Financial Viability

Designers of natural resource management projects in Rwanda often have little reliable information to conduct an adequate analysis of the investment costs and financial viability of technologies that are being promoted to improve resource management. This information is crucial to enable project designers to assess the economic potential of such techniques and to address the issues of cost recovery and whether subsidies are necessary. Without such information, project designers might inadvertently make erroneous assumptions about the financial viability of proposed projects.

The problem of inadequate data was encountered during implementation of the first phase of the World Bank's Integrated Forestry project. A key component of the project was to establish a dairy industry by converting degraded portions of the Gishwati Forest into pastures and setting up a private dairy processing enterprise. The project rented out pastures and provided loans from commercial banks for individuals to purchase imported livestock. According to the World Bank's review of the project's performance, the costs of establishing the pastures turned out to be significantly higher than anticipated because of the high price of materials and management inadequacies (World Bank 1987b).

Under the circumstances, the World Bank noted that the financial viability of the dairy farms and processing enterprise set up by the project would be jeopardized if the project were to absorb all the costs of establishing the pastures. Therefore, the World Bank recommended that the Government of Rwanda absorb 50 percent of the costs as a subsidy ("sunk costs") and the remainder from loan repayments and rents collected from the dairy enterprises and livestock owners. The Bank also recommended a significant increase in interest rates on loans received by project beneficiaries. It took more than a year to resolve the issue as the Government was initially reluctant to raise interest rates for fear of losing support for the project. Similar conditions for cost recovery have been imposed on the livestock component of the current, second phase of the Integrated Forestry project.

The lack of adequate economic information on natural resource management technologies is not unique to the World Bank project. At present, there is little economic data on soil conservation, agroforestry, and natural forest management techniques being proposed for the various projects currently being implemented in Rwanda. Therefore, their economic feasibility is not yet known. As the World Bank project's experience indicates, it is possible that some projects might be so costly as to be unviable, and the Government of Rwanda obviously cannot afford to subsidize all of them.

Steps are being taken to address this issue. Three projects with major agroforestry components--the World Bank's Second In-

tegrated Forestry project, USAID/Kigali's NRMP, and the EEC's project in Nyungwe--plan to include market and farm-level studies that will generate data on the costs and benefits of the agroforestry techniques they promote. The information will be used to monitor the economic impact of each project and will provide a comparison of the cost-effectiveness of the agroforestry techniques promoted by the three projects. Although there are no plans at present, such findings could guide the design of future agroforestry projects, which might easily be conducted by the Rwandan Institute for Agricultural Research or a local university.

4.2 The Weaknesses of and the Lack of Coordination Among Government Agencies

As in many developing countries, Rwandan Government agencies lack the staff and financial resources to implement development programs effectively. For example, the Ministry of Agriculture, the principal ministry responsible for agricultural production and the management of natural resources, receives less than 4.4 percent of the Government development budget. In the past 10 years, the World Bank and the Swiss Aid Agency have provided institutional support. Both donors provided assistance to set up a national forest service, and the World Bank will soon fund a project to strengthen the extension system. However, because institutional strengthening takes a long time to produce results, the problem of weak forestry and agricultural services will persist for a while.

Furthermore, because there are at least seven Government agencies with jurisdiction over different aspects of natural resources management, effective implementation of these projects will require coordination. Accomplishing this coordination will be a challenge because the agencies that need to work together often have overlapping interests that generate more competition than cooperation. For example, six ministries have responsibilities for the marais, and each has a different perspective on how to develop them. And within one of the ministries, three offices control land use in the marais.

In a recent workshop to discuss the design of USAID/Kigali's NRMP, the audience was reminded that the proposal to improve the management of the Volcanoes Park had to be assessed by both the Ministry of Tourism and the Ministry of Agriculture's Forestry Department. The Ministry of Tourism is responsible for the protection of the mountain gorillas in the park, while the Ministry of Agriculture's Forestry Department has authority over how to manage their habitat. Therefore, each ministry has a different perspective in setting priorities to protect the biological diversity of the forests in the Volcanoes Park.

The ongoing effort to develop a national "Environmental Action Plan" provides an opportunity for coordination among all seven ministries participating in the USAID/Kigali NRMP. Nonetheless, how this will be accomplished and what will motivate the ministries to cooperate, rather than compete, with one another remains to be seen.

5. CONCLUSION

Rwanda's natural resource management problems are typical of those found elsewhere in developing countries in that they stem from land-use practices that are destroying or stressing the country's natural resources. If the problems are not resolved, the country's economic development will be undermined. Nevertheless, Rwanda is an exception in that it has not had severe macroeconomic setbacks and there has been no egregious misuse of its natural resources. On the contrary, as indicated in this paper, important steps are already being taken to address existing or emerging problems.

Rwanda's experience illustrates the process through which natural resource issues can be incorporated into a country's development agenda. It underscores the importance of a government's creating a supportive policy and institutional environment. The Government of Rwanda's interest in natural resource issues has encouraged the implementation of management practices that progressed quickly from launching tree-planting campaigns to developing more long-term strategies. This is no small accomplishment, given the financial and political risks the Government took in investing in activities whose economic potential is yet to be realized.

The Government of Rwanda's commitment, in turn, has encouraged the donor community to assist with policy formulation and to address natural resource management issues through their respective development programs. Grants and concessionary aid provided by A.I.D. and other bilateral donors have helped to underwrite some of the related risks of technology and institutional development. USAID/Kigali has also augmented funding for projects with additional support from centrally funded A.I.D./ Washington projects and through match-funding with PVOs. Donors have concentrated primarily on supporting individual agricultural and forestry projects that deal with specific problems (i.e., soil depletion, soil erosion, deforestation, and drainage problems in the small marais). However, for more complex issues, such as those related to natural forest management and formulation of an "Environmental Action Plan," A.I.D. and other donors have found it necessary and mutually useful to coordinate their activities and, in some instances, to pool their resources.

USAID/Kigali's contribution to Rwanda's natural resources management program illustrates how, apart from standard reforestation projects, other environmental and conservation measures can be incorporated into an A.I.D. agricultural and rural program to improve the long-term benefits of development assistance without compromising the economic objectives. Activities that have both ecological and economic benefits include (1) tourism and other nondestructive use of natural forests in conjunction with wildlife conservation and park management and (2) agroforestry or fish-farming that conserve soil and water resources while increasing farm productivity.

Such innovative approaches, however, can be difficult to appraise (in purely economic terms) for project funding purposes. New management practices often require costly investments, the major ecological and economic benefits of which may not be apparent for many years or cannot be easily estimated during project planning. Consequently, project designers may find it inappropriate to use standard cost-benefit analysis as a criterion for determining the returns on such investments because it would not take into account the long-term or nonquantifiable benefits. Without a strong economic justification for such investments, a Mission with a limited development budget might find it difficult to justify placing a higher priority on natural resource management investments over other types of development activities that can yield more immediate and tangible benefits.

In Rwanda, this conflict is particularly apparent in areas such as wildlife research, park and forest management, and environmental monitoring systems. Although these activities are necessary to ensure that vital natural forest and aquatic ecosystems are not harmed by the juxtaposition of development and conservation, they require many years of support with little immediate results. For example, after 10 years of research in the Volcanoes Park, scientists still do not know the acreage of natural forest that should be maintained as intact ecosystems to ensure the viability of the mountain gorilla and other wildlife populations. Yet without this information, it is impossible to determine how much of the park's protected forest should be accessible to tourists and other users. In the meantime, additional support for research and park management activities is needed to continue the work on answering this question.

The foregoing discussion should not imply that economic criteria should not be used to appraise resource management approaches that require long-term investments or are research-oriented or experimental. On the contrary, Rwanda's experience suggests that economic aspects of natural resource management are crucial, but should not be the sole criteria used to identify strategies to address resource issues. These considerations underscore the need for project designers to (1) take into account

the ecological as well as the economic contribution of a resource management activity, (2) consider investments from both a long-term and short-term perspective, and (3) include qualitative and quantitative benefits in appraising the potential returns on investments. In other words, a broader framework than a simple cost-benefit analysis of a proposed activity might be required.

Rwanda's experience of protecting its natural resources suggests several measures that can be incorporated into A.I.D.'s development programs in other countries. First, support from the host country government could be encouraged by funding studies of existing or emerging natural resource issues to heighten awareness and to identify how resource management could be included in development programs. Conferences with respected experts, workshops, and study trips to observe natural resource management in other countries might also heighten host country awareness of the problems and the need to take action. For example, the studies could be undertaken in conjunction with the economic and social analyses needed for preparation of the USAID Mission's Country Development Strategy Statement. Second, in dealing with complex resource issues, collaboration with other donors in funding studies might be necessary, and could be undertaken with support from centrally funded projects. Third, A.I.D. could develop intervention programs ranging from small-scale, on-farm agroforestry, soil conservation, and water management to projects covering large areas that combine resources conservation with development activities.

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